

INTERSCAPULO-THORACIC AMPUTATION.¹

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BERGER, in 1891, advocated interscapulo-thoracic amputation in all cases of malignant disease of the upper extremity of the humerus in preference to the disarticulation of the humerus. This was advocated in a discussion before the Surgical Society of Paris. Monod, of Bordeaux, presented a paper at that meeting upon "Interscapulo-Thoracic Amputation." There was some divergence of opinion as to the necessity of sacrificing the extremity in this class of cases. Some were in favor of resection.

Lejars, in 1896, reported to the Surgical Congress, convened at Paris, a case of resection of the upper extremity of the humerus for periosteal sarcoma, in which the cure was permanent. This again attracted Berger's attention to the matter, and he began a systematic search for other cases of this kind. This search resulted in establishing to his own satisfaction that in cases of malignant disease of the upper extremity of the humerus interscapulo-thoracic amputation was the operation of choice. In his researches particular attention was paid to those cases in which disarticulation had been done, and in which recurrence had necessitated subsequent removal of the scapula. This further strengthened his opinion regarding the complete amputation. He advocated a method of operating which he claimed to be methodical, rapid, and free from danger, and which in two

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cases of his own had proved of permanent benefit. His first case, a country postman, was free from recurrence and pursuing his occupation sixteen years after the operation. The tumor in this case was an enchondroma. The second case, a myxoma, was free from recurrence eighteen months after the operation. In 1887, Berger published his first table of cases of interseapulo-thoracic amputation. This included fifty-one cases, only six of which were necessitated by malignant disease of the humerus, including his first case. Since then Adelmann, Schultz, Nasse, and others have collected series of cases. In 1898, Berger again tabulated a number of cases. Many of these are of use only in calculating the mortality of the operation. The table makes the mortality of the operation entirely too low, and in fact gives too rosy a view of the operation.

The *indications* for interseapulo-thoracic amputation are fairly well defined. The operation has been done in cases of extensive injury to the arm and shoulder region, involving so considerable a loss as to render the life of the member improbable. Such injuries have been produced by machinery accidents in which the arm and part of the scapula have been torn away, partially or completely; by compound comminuted fractures of the shoulder region; by gunshot and explosion accidents; by extensive lacerations from the bites of animals; by extensive burns. The operation has been done for caries, extensive local tuberculosis, for gangrene and sepsis, for osteomyelitis. It is indicated in injuries of the brachial plexus in the neck (such as are produced by stab-wounds) resulting in paralysis, severe neuritis, and trophic disturbances, which do not yield or are not benefited by operation (suturing of the cords of the plexus in the neck); also in cases of pain of the entire upper extremity, due to severe neuritis, which does not yield to other treatment or to section of the brachial plexus in the neck, or to section of the posterior nerve-roots. In cases of carcinoma of the breast, whether recurrent or primary, involving the axillary vein and brachial plexus, and thus producing œdema and pain. In benign tumors which, by reason of their location and great size, render the extremity painful and useless, and in which malignant changes might be expected to

take place. The operation is indicated in malignant tumors, particularly sarcoma, at or in the neighborhood of the shoulder-joint. I wish to add that *this operation should be done in all cases of malignant disease of the humerus, however located, whether in the upper extremity, shaft, or lower extremity of the bone.*

Operation: First Step.—The patient is placed flat on the back with a small sand-bag between the scapulae, the affected side overhanging the edge of the table. This throws the clavicle well forward. During anesthetization the arm is elevated and abducted in order that as little blood as possible may be removed with it. No tourniquet or bandaging of the arm is to be employed for the purpose of rendering it bloodless, as the pressure might result in the forcing of tumor products, tubercular infection, or sepsis, directly or indirectly into the general circulation. A straight incision is made over the clavicle extending from the insertion of the sterno-mastoid to the acromion. This incision is deepened to the periosteum, which is divided and pushed back. A chain-saw is passed around the inner third of the clavicle and the bone sawn through. The outer portion is now elevated and separated from the underlying subclavius muscle and periosteum, and a section three inches in length removed. This brings into view the subclavius muscle, which is cut through close to its attachment to the clavicle. By thoroughly sectioning and turning outward the subclavius muscle abundance of room is obtained in which to secure the vessels. The several layers of fascia which overlie the vessels at this point are divided. The upper border of the pectoralis minor should now be seen in the field of operation. The external anterior thoracic nerve is one of the guides to the vessels. It can be both seen and felt leading upward to the interval between the artery and vein. If it does not come into the field of operation, as was the case in one of Keen's cases and in my own, it can readily be found. Careful digital exploration for the arterial beat will always be a sure guide, except in cases of profound shock, when the external anterior thoracic nerve will be found useful. There may be some bleeding during this first step from the acromio-thoracic and from the cephalic

vein. The subclavian artery and vein, being identified, are well isolated, and a double ligature of braided fine catgut or of coarse single strands of catgut are tied, one inch apart, on the artery and vein separately, and the vessels divided between them. All ligatures should be placed before being tightened, those on the artery being tied first. Treves recommends the latter in order that as little blood as possible be left in the extremity. Other operators, among them Keen and Wyeth, have also called attention to this. The isolation of the vessels is to be carefully done. Any injury to the vein may result in the entrance of air and possibly consequent death. The suprascapular vessels should be secured. They will generally be seen crossing the upper portion of the wound. Every vessel during this stage should be clamped as soon as cut, so that no blood will obscure the field of operation.

Second Step.—The second stage consists in marking out and reflecting the flaps. As much of the skin and soft parts is to be removed as compatible with the accurate apposition of the flaps without puckering. The patient is partially turned upon the unaffected side. The arm is placed under the control of an assistant, who attends solely to carrying out the operator's directions as to its position. The extremity is partially abducted, and a skin incision, beginning at about the inner third of the clavicular incision, is carried downward and outward over the portion of the pectoralis major which forms the anterior boundary of the axilla, and thence downward and outward to the anterior border of the latissimus dorsi. During the latter part of this incision the extremity is further abducted, so that when the latissimus dorsi is reached the extremity is at a right angle with the body. The arm is now brought forward across the chest and the posterior flap marked out. The posterior incision commences from the same point on the clavicular incision as did the anterior, and, crossing the spine of the scapula in a downward and outward direction, ends at the terminal point of the anterior incision. The extremity is drawn away from the body, thus throwing into prominence the pectoralis major. This is divided, and the tendon of the minor cut. The brachial plexus is sectioned at the same level as the ligated vessels. The patient

is further turned on the unaffected side, and the arm again thrown across the chest, the posterior flap reflected to the vertebral border of the scapula, and the muscles attached there severed. At this point the posterior scapular vessels must be secured, and also the suprascapular, if these have not been ligated during the first step. If no anomalies are present, very few ligatures will be required. The preliminary ligation of the subclavian absolutely shuts off all blood-supply to the parts, with the exception of the suprascapular and posterior scapular. The flaps as outlined above differ slightly from those advocated by Faraboeuf. The flaps must depend to a great extent upon the condition for which the amputation is done. Keen's flaps were modified to suit the exigencies of his case.

Advantages of the Described Operation.—(1) Hæmorrhage is absolutely prevented. (2) The danger of wounding or tearing the vein, and thus admitting air into the circulation, is minimized. (3) The only point where arterial bleeding can occur is while sectioning the scapular muscles. This is left till last.

Complications.—Difficulty in finding the artery. This might happen in case of large tumors displacing the artery. Such a case has been reported (Macnamara).

Difficulty in finding the vein. This might occur in traumatic cases in which extreme injury to the vessels in the neighborhood of the shoulder-joint would result in collapse of the vein. Parise reported such a case.

Even in comparatively uncomplicated cases, the ligation of vessels is a matter which requires patience. It takes more time than all the rest of the operation. Having secured the vessels, the operation is simplicity itself and quickly performed. The whole success of the procedure depends upon the accurate localization of the artery and vein, and their ligation without unnecessary traumatism.

Dangers of the Operation: Hæmorrhage.—This may arise from severing of the main trunk, the axillary branches, or the enlarged veins in the neighborhood of a tumor. Preliminary ligation fairly meets the first two of these conditions, and goes far towards preventing the third. It obviates the danger of air entering the large veins and prevents all bleeding from the large

wound, except during the division of the scapular muscles, the blood-supply of which is not cut off. If, on account of the size and position of the growth, it is found impossible to ligate the subclavian after division of the clavicle, the pectoralis major and minor may be divided and the axillary artery tied as high up as is possible; or tracing it up to the scalenus anticus, there ligate the subclavian artery.

The danger of hæmorrhage cannot be overestimated. The immediate success of the operation depends to a great extent upon the amount of blood lost. The control of hæmorrhage is, as Keen has aptly said, "the key to the entire situation." There are several methods of controlling hæmorrhage, the best of which has been incorporated in the description of the operation given above, the method commonly associated with the name of Berger. Other methods have been used, chief among them being simple compression of the subclavian artery, compression of the subclavian artery after resection of the clavicle, preliminary ligation of the artery without resection, ligation of the artery after resection of the middle third of the clavicle, leaving the vein and brachial plexus until the rest of the operation has been completed, then section of the plexus and ligation of the vein. This last is done in order that as little blood as possible may be removed with the extremity. It was used by Wyeth in one of his cases, but is open to the objection of the danger of tearing the vein during the necessary manipulations of the arm, and thus affording an opportunity for the entrance of air. Disarticulation of the sternal end of the clavicle and ligation of the vessels under the inner third have been done. Secondary hæmorrhage may occur. Chavasse reports an interesting case in which this occurred on the seventeenth day. It was necessary to make a further resection of the clavicle and secure the subclavian artery in front of the scaleni.

Shock.—The main preventive measure is preliminary hæmostasis. The extremity should be emptied of as much blood as possible by elevation, but, as pointed out above, the Esmarch bandage should not be used in cases where tumor products or sepsis might be forced into the circulation. In other respects, shock should be met as in other cases, by the liberal use of

strychnine, whiskey, heat, enemata of hot saline solution, and intravenous infusion.

Septicæmia.—This is mentioned by Jacobson as a possible danger if badly coapted flaps are left. Retention should never occur, nor should there be any trouble in making well-fitting and closely approximated flaps. The facilities for drainage are perfect, far better than in disarticulation at the shoulder-joint, and if septicæmia occur, due to puckering of the flaps or retention of discharge, it is an unpardonable accident. More or less prolonged suppuration was a complication of some of the cases reported, but in only one case was sepsis of grave import. In Berger's first case a retained rubber drainage-tube caused a fistulous tract to persist until the discovery of the tube and its removal.

Entrance of Air into the Veins.¹—This has been noted in a number of cases of interscapulo-thoracic amputation, and in some instances has nearly proved fatal. Mussey's case (1837) was such an one. The symptoms are immediate and alarming. The pulse becomes weak and rapid, respirations become slower and slower. Death occurs with symptoms of cerebral anæmia. The treatment is persistent artificial respiration, the injection of cardiac stimulants directly into the circulation, and in some cases the application of a closed piston-syringe to the proximal end of the injured vein, and the mechanical withdrawal of the aspired air mixed with blood from the heart.

In twenty cases collected by Gross in 1867, in which the internal jugular was wounded, five died from entrance of air into the vein.

Lane, of San Francisco, had an opportunity of studying the effect of the entrance of air into a vein through which a transfusion was being done. After a quantity of fluid had entered the circulation, by some mischance air entered, with the result that the patient gave a convulsive gasp and died (L. C. Lane, "Surgery of the Head and Neck," p. 1136).

Reddy in 1667 mentioned the entrance of air into a vein. In 1842 there were reported several deaths from this cause. In

¹ L. C. Lane, *Surgery of the Head and Neck*, San Francisco.

a case of simple bleeding from the basilic vein, death is reported to have occurred through the entrance of air (Simon).

Several writers have offered explanations of the cause of death. Marchal believed that the mixture of air and blood formed carbonic acid which poisoned the system. Mercier taught that air and blood formed an elastic mixture which the heart was unable to propel, and which regurgitated into the veins; that even if this mixture reached the lungs it was impossible for it to pass them. Wattman in 1842 observed that this accident occurs when the veins are tense, when they are thickened, and when they are only partially divided. When a hissing sound is heard, it indicates that the air is entering a vein; when the sound is a gurgling one, that air and blood are mixing. The symptoms noted by this observer were that the patient made an outcry, became pale, covered with perspiration, lost consciousness, and died in a convulsion. In 1843, Erichsen wrote that the blood and air combined to form foam, which could not pass through the vessels in the lungs. Elliot claimed that it was impossible for the air to pass the heart; that it was alternately driven from the right ventricle to the auricle and back; that air expanded the heart and thus lessened its power; that if the air reached the lungs it was there cooled and forced to return to the heart. In cases in which there is a probability of the entrance of air, Erichsen advocated bandaging of the thorax as a precautionary measure, as the air was sucked into the veins during deep inspiration. Gay, while removing a tumor from the axilla, had air enter a vein. This case is also reported by Lane. There was syncope, and the patient did not rally for an hour.

The autopsies performed upon cases which have succumbed to this accident show a contracted left ventricle; the right side of the heart, more especially the ventricle, being full of blood mixed with air; also blood and air in the pulmonary artery; lungs congested and containing mixed blood and air. Death is due to asphyxia, not to the irritation of air in the cerebral vessels, as taught by Bichet, nor from paralysis of the heart, nor from the presence of carbonic acid, as taught by others.

In 1876, Couty, of Paris, wrote upon this subject. He

claimed that death was not due to embolic obstruction in the lungs, but caused by a systole of the right heart, resulting from the presence of air there, and, as a final result, death is due to suspension of the pulmonic circulation. Couty divided the phenomena into four stages: (1) Diminished aortic pressure and increased cardiac action. (2) Aortic pressure still further diminished and further increase in heart's action. In this stage there is pallor, syncope, rapid breathing, and dilated pupils. (3) Blood-pressure vanishes, breathing is slow, urine and feces escape involuntarily. (4) Cessation of breathing and later cessation of heart action. In 1876, Picard experimented on animals by injecting air into the portal vein. This produced hyperæmia of the rootlets of the portal system, increased the rapidity of the heart, slowed respiration, and lowered temperature. In 1877, Fisher reported two cases in Volkmann's *Klinische Vorträge*, both of which recovered. In Fisher's case recovery took place by coughing, blood being thereby forced from the wounded vein, carrying with it the contained air. In 1859-1860, Dr. E. S. Cooper, of San Francisco, before his class of students, forced air (by means of a piston-syringe) into the femoral vein of a dog. The dog immediately stopped breathing and seemed to be dead. The piston of the syringe was then drawn back, causing blood and with it the injected air to flow into the barrel of the syringe, with the effect of restoring the dog to life. This treatment might be applied to patients the victims of this accident (Lane). Uterhart, of Berlin, in 1870, injected air into the veins of dogs. He found that when air was injected at a considerable distance from the heart, as the femoral vein, no injury resulted, but if injected into the external jugular, there followed speedy death with symptoms of cerebral anæmia. Air thrown into the arteries was followed by no ill effects, whether injected near to or at a distance from the heart.

ABSTRACT OF RECORDED CASES.

(1) Primary interscapulo-thoracic amputation for malignant disease (without previous resection or disarticulation), seventy-two cases.

I have been able to collect seventy-two cases in which

primary interseapulo-thoracic amputation was done for malignant disease of the humerus. Some from Berger's table are included and some are rejected, according as they fulfilled the requirements or not. To be placed in this table the interseapulo-thoracic amputation must have been primary,—that is, done without previous resection or disarticulation. Some cases have, indeed, been placed in this table which had previously had other operations, but in which the previous procedures could have had no effect in increasing the danger of the final operation or influencing the final result.

CASE I (1838).—Twitchell, of Keene, N. H. Malignant tumor. Interseapulo-thoracic amputation: recovery. Death from recurrence in a few months. This case was never reported by the operator, who kept no notes of the case. His nephew, Dr. G. B. Twitchell, furnished these notes to Stephen Rogers. Reference, *New York Medical Journal*, 1869, viii, p. 434.

CASE II (1838).—G. MacClellan. Male, aged seventeen. Encephaloma. Interseapulo-thoracic amputation, most of the clavicle being removed: recovery. Death from recurrence in six months. Claimed by author to be the first case on record of primary interseapulo-thoracic amputation. Reference, MacClellan's "Surgery," 1848, p. 412.

CASE III (1845).—R. D. Mussey, Cincinnati. Male, aged fifty-six. Osteocancer. Interseapulo-thoracic amputation, one-half of the clavicle being removed: recovery. No recurrence nine years after the operation. Reference, *American Journal*, 1837-38, p. 386.

CASE IV (1862).—J. C. Whishaw, Fyzabad, E. I. Male, aged eight. Encephaloma of the scapular region, shoulder-joint, and clavicle. Interseapulo-thoracic amputation: recovery. No recurrence several months later. Reference, *Lancet*, London, 1874, i, p. 819.

CASE V (1867, June 30). Kenneth McLeod. Male, aged two. Enormous encephaloid tumor of the right arm, extending from the elbow to the infraspinous fossa; congenital; seventeen inches in circumference, tense, and fluctuating. Exploratory puncture showed blood. Patient was in a very weak state. Interseapulo-thoracic amputation, a skewer being used to control hemorrhage. Death from shock soon after the operation. Reference, Reprinted from the *Indian Medical Gazette*, September, 1867; *Edinburgh Medical Journal*, 1869, Vol. xv, Part i, p. 567.

CASE VI (1867, September 2). Thiersch, Leipzig. Male, aged thirty-four. Enehondroma molle of the right shoulder region; had been present for one year. Interseapulo-thoracic amputation. During the operation air twice entered the axillary vein. Death in five days, with symptoms of œdema of the lungs. Autopsy revealed a sero-purulent collection in the left pleural cavity. The pulmonary artery and vein were surrounded by a mass of enehondroma. Reference, Wagner's *Archiv für Heilkunde*, Jahrgang x, 1869, S. 460 (Bireh-Hirschfeld).

CASE VII (1867, October).—William Fergusson, London. Male, aged forty. Osteosarcoma of the shoulder. Tumor followed a fall on the shoulder two years before. Interseapulo-thoracic amputation. Chloroform. Six ounces of blood lost. Shock. Death occurred four days later. Autopsy showed fatty condition of the heart, liver, and kidneys. Reference, *Medical Times and Gazette*, 1867, Vol. ii, p. 465; *Lancet*, London, 1867, Vol. ii, p. 465; *Lancet*, London, 1867, Vol. ii, pp. 525 and 552.

CASE VIII (1873).—Parise, Lille. Male, aged twenty. Osteosarcoma. Interseapulo-thoracic amputation, with preliminary ligature of the subclavian artery and vein: recovery. Death from recurrence in the lung in eighteen months. Reference, De Langenhagen, "Contribution à l'étude clinique des Tumeurs du Scapulum," Paris, 1883, p. 102.

CASE IX (1873, December 19).—B. von Langenbeek, Berlin. Male, aged seventeen. Vascular sarcoma of the whole shoulder region. Tumor had been present for fifteen months. Interseapulo-thoracic amputation. Death on the fifth day from hæmorrhage due to the slipping of the ligature on the subclavian artery. Reference, Joh. Veit, "Exstirpation von Schulterblatt und Arm," Inaugural Dissertation, Berlin, 1874.

CASE X (1878).—C. Macnamara. Female, aged twenty-four. Chondrosarcoma of the right shoulder, scapula, axilla, and pectoral muscles, of nearly four years' duration, and of the size of an infant's head. The right arm and hand were œdematous, and the brachial pulse feeble. Interseapulo-thoracic amputation. The size and position of the tumor made it impossible to find and ligate the subclavian artery, consequently the hæmorrhage was profuse. Death on the following day from shock. Reference, *Lancet*, London, 1878, Vol. i, p. 669.

CASE XI (1879, October 3).—Edward Lind. Male, aged twenty. Spindle-celled sarcoma of the shoulder-joint, of about four months'

duration. Exploratory incision through the deltoid for purposes of diagnosis. Interscapulo-thoracic amputation: recovery. No subsequent data. Reference, *British Medical Journal*, 1880, Vol. ii, p. 617.

CASE XII (1880, May).—A. P. McGill. Female, aged fifty-eight. Rapidly growing tumor of the left scapula and axilla. Interscapulo-thoracic amputation. Death from infection on the sixth day. Reference, *British Medical Journal*, 1880, Vol. ii, p. 702.

CASE XIII (1880?).—Joseph Bell. Male, aged ten. Sarcoma of several months' duration, involving the supra- and infrascapular regions and axilla. Interscapulo-thoracic amputation, curved skewer being used to control the hæmorrhage: recovery. No further data. Reference, *Edinburgh Medical Journal*, 1885-86, Vol. i, p. 168.

CASE XIV (1882, October 28).—Paul Berger, Paris. Male, aged twenty-seven. Enchondroma. Interscapulo-thoracic amputation: recovery. No recurrence after fifteen years. Reference, *Revue de Chirurgie*, 1898, No. 10.

CASE XV (1883, December 20; 1884, July 15).—Czerny, Heidelberg. Male, aged forty-one. Spindle-celled sarcoma. Extirpation of the tumor was first done, later interscapulo-thoracic amputation: recovery. Death in December, 1884, from tuberculosis of the lungs and larynx. No autopsy. Reference, *Archiv für klinische Chirurgie*, Band xxxvii, 1888. S. 135.

CASE XVI (1883, July).—Kenneth McLeod. Male, aged twenty. Sarcoma of the arm, shoulder, and axilla. Interscapulo-thoracic amputation: recovery. No subsequent history. Reference, *Lancet*, London, 1890, Vol. i, p. 847.

CASE XVII (1883, July 4).—Christopher Heath, London. Male, aged sixteen. Ossifying sarcoma, having started two years before as a slight thickening of the upper extremity of the humerus, increasing rapidly in the last six months. Involved the scapula and completely fixed the shoulder-joint. Interscapulo-thoracic amputation, the scapula being removed in two parts: recovery. No recurrence seven and one-half months after the operation, except a small nodule in the neighborhood of the scar, which Mr. Heath subsequently removed. No recurrence until Christmas, 1885, two and one-half years after the first operation. May 8, 1886, a small, freely movable nodule was removed from the pectoral muscle and scar. The case was well on July 8 of the same year. Reference, *British Medical Journal*, 1884, Vol. i, p. 412, also 1886, Vol. ii, p. 68.

CASE XVIII (1883, November 2).—Verneuil, Paris. Male, aged

twenty-three. Osteosarcoma of the shoulder involving the scapula and axilla. Interscapulo-thoracic amputation, the scapula being removed in two portions: recovery. Recurrence in six months, and finally death from involvement of the vertebral column. Paraplegia. Reference, *L'Union Médicale*, 1884, p. 1; L. M. Sambucy, "De l'Ablation totale du Membre supérieur avec l'Omoplate," Thèse, Paris, 1883, p. 37.

CASE XIX (1886, January 22).—E. A. Maling. Male, aged fifty. Sarcoma of the scapula, triceps, and humerus, first noted ten months before. After an aspiration had been done tumor grew rapidly and patient began to lose weight. Interscapulo-thoracic amputation: recovery. Recurrence took place in the right parietal region one month later. Reference, *British Medical Journal*, 1886, Vol. i, p. 500, also Vol. ii, p. 1161.

CASE XX (1886, October 13).—Alfonso Poggi, Bologna. Male, aged twenty-seven. Fibrosarcoma of one year's duration. Interscapulo-thoracic amputation. Preliminary ligature of the subclavian was rendered impossible by the size of the growth: recovery. No recurrence three months after operation. Reference, *Bullerino delle scienze mediche di Bologna*, Ser. vi, Vol. xxi, 1888.

CASE XXI (1887, June).—Bennet May. Female, aged twenty-one. Mixed-celled periosteal sarcoma of the upper end of the humerus, englobing the articulation, the movements of which were fairly free. The disease was of two years' duration. There was a movable secondary tumor in the axilla and a movable nodule in the supraclavicular fossa. Interscapulo-thoracic amputation: recovery. Rapid recurrence in the cervical glands and death within the year. Reference, *ANNALS OF SURGERY*, 1888, Vol. viii, p. 435.

CASE XXII (1887, February 5-17).—Carl Reyer, St. Petersburg. Male, aged fifty-three. Sarcoma first noted March, 1886. In July, 1886, a spindle-celled sarcoma, the size of a goose-egg, was removed. Recurred in October. At time of operation tumor involved shoulder region. Interscapulo-thoracic amputation. Transplantation of human and frog's skin. Recovery. Death from recurrence in the lung in eleven months. Reference, Communicated by the operator to Adelman.

CASE XXIII (1887).—Van Iterson. Male, aged forty-nine. Central osteosarcoma of the head of the humerus with involvement of the scapular muscles. Interscapulo-thoracic amputation: recovery. Still free from recurrence eight months after operation. Reference, *Bulletin de la Société de Chirurgie*, 1887, Vol. xiv, p. 481.

CASE XXIV (1888).—Sondermayer. Female, aged forty-four. Spindle-celled sarcoma of the humerus. Interscapulo-thoracic amputation: recovery. No recurrence in nine months. Reference, *Wiener medizinische Wochenschrift*, 1888, No. 29, 1120 (1889, 39, 1121).

CASE XXV (1888, May).—Bennet May. Male, aged seventeen. Sarcoma of upper end of right humerus of six months' duration, obscuring the shoulder, filling the axilla, overlapping the scapula. Joint movements fairly free. Interscapulo-thoracic amputation: recovery. No recurrence between seven and eight months after operation. Reference, *ANNALS OF SURGERY*, 1888, Vol. viii, p. 437.

CASE XXVI (1888).—V. Bergmann. Male, aged ten. Osteo-sarcoma of the upper one-third of humerus. Interscapulo-thoracic amputation: recovery. Recurrence and death in ten months. Reference, Nasse.

CASE XXVII (1888).—Charles T. Parkes. Male, a youth. Sarcoma of the upper extremity of the humerus involving the shoulder-joint. Interscapulo-thoracic amputation: recovery. No recurrence when last seen, six months after the operation. Reference, *Journal of the American Medical Association*, 1889, Vol. ii, p. 295.

CASE XXVIII (1888, January 24).—V. Bergmann, Berlin. Female, aged thirty-four. Sarcoma of the left humerus. There had been pain and discomfort in the shoulder for two years. Spontaneous fracture of the humerus ten months before. Interscapulo-thoracic amputation: recovery. No data concerning recurrence. Reference, Bramsfeld, "Dissertation," p. 28.

CASE XXIX (1889, January).—Thomas T. Chavasse. Male, aged forty. Chondroma of ten years' duration of upper portion of right humerus. The clinical diagnosis of chondrosarcoma was made. Interscapulo-thoracic amputation. Secondary hæmorrhage occurred on the seventeenth day requiring ligation of the second part of the subclavian. Tumor weighed eighteen pounds. Recovery. No recurrence one year after operation. Reference, *British Medical Journal*, 1890, Vol. i, p. 131; also *Lancet*, London, 1890, Vol. i, p. 131.

CASE XXX (1889).—Charles T. Parkes. Male, aged thirty-seven. Sarcoma of the shoulder region. Interscapulo-thoracic amputation. Three weeks before operation the tumor had been removed as far as external manifestations. Patient reacted nicely at first, but death occurred fifty-six hours later. Reference, *Journal of the American Medical Association*, 1889, Vol. ii, p. 295.

CASE XXXI (1889).—Southam. Female, aged eleven. Round-celled sarcoma of the scapula, shoulder, and axilla. Interscapulo-thoracic amputation: recovery. No recurrence up to six weeks. Prognosis bad. Reference, *British Medical Journal*, 1889, Vol. ii, p. 1334.

CASE XXXII (1889).—Ktister. Female, aged twenty-nine. Sarcoma of humerus. Several spontaneous fractures. Interscapulo-thoracic amputation: recovery. No further data. Reference, Berger.

CASE XXXIII (1889, April).—Edwin A. Lewis. Male, aged forty-seven. Osteosarcoma of humerus following an injury two years before. Involved shoulder-joint. Interscapulo-thoracic amputation: recovery. No recurrence eight months after operation. Reference, *ANNALS OF SURGERY*, 1890, Vol. ii, p. 88.

CASE XXXIV (1889).—Von Bergmann. Encapsulated periosteal sarcoma of humerus. Interscapulo-thoracic amputation: recovery. No recurrence three and a half years after operation. Reference, Nasse, Berger.

CASE XXXV (1890, October 14).—John A. Wyeth. Male, aged fifty-four. Sarcoma. Interscapulo-thoracic amputation. Nine months before a tumor had been removed from the long head of the triceps. This recurred in less than six months. A small nodule was removed from beneath the chin three weeks after the operation. There was present œdema of the arm. Recovery. No recurrence two months after the operation. Reference, *New York Medical Journal*, 1891, Vol. i, p. 57.

CASE XXXVI (1891).—Ochsner. Female, aged nineteen. Sarcoma of humerus. Interscapulo-thoracic amputation: recovery. No recurrence four years after operation. Reference, *ANNALS OF SURGERY*, Philadelphia, 1895, Vol. xxii, p. 736.

CASE XXXVII (1891).—E. Monod. Male, aged twenty. Periosteal sarcoma of humerus with involvement of the muscles. Interscapulo-thoracic amputation: recovery. Recurrence in the lungs in three months. Reference, *Bulletin de la Société de Chirurgie*, 1891, Vol. xvii, p. 201.

CASE XXXVIII (1891).—Frederick Treves. Female, aged forty-three. Round celled sarcoma of the upper part of the right humerus, involving the shoulder-joint and the deltoid muscle. Interscapulo-thoracic amputation: recovery. Left hospital on the twentieth day. No subsequent history. Reference, *Lancet*, London, 1891, Vol. ii, p. 1159.

CASE XXXIX (1891).—DeIorme. Male, aged twenty. Sarcoma of the head of the humerus. Interscapulo-thoracic amputation. Recovery. No further data. Reference, *Semaine Médicale*, 1892, 252.

CASE XL (1891).—Von Bergmann. Sarcoma of the humerus involving the muscles. Interscapulo-thoracic amputation: recovery. Death from recurrence shortly after the operation. Reference, Nasse.

CASE XLI (1891).—Von Bergmann. Sarcoma of humerus involving the muscles and subclavian vein. Interscapulo-thoracic amputation: recovery. Death from recurrence shortly after the operation. Reference, Nasse.

CASE XLII (1891, March 23).—Kenneth McLeod. Female, aged fifteen. Spindle-celled sarcoma, involving the right scapula, clavicle, and humerus. Arm œdematous. Right radial pulse weak. Three months' history. Interscapulo-thoracic amputation. Skewer method. Recovery. No subsequent data. Reference, *Indian Medical Gazette*, 1891, xxvi, p. 147.

CASE XLIII (1892).—Von Bergmann.—Cystic sarcoma of the humerus. Interscapulo-thoracic amputation: recovery. No recurrence one year after operation. Death from some unknown cause. Reference, Nasse.

CASE XLIV (1892).—Von Bergmann. Sarcoma of the head of the humerus. Interscapulo-thoracic amputation: recovery. No recurrence at the end of one year. Reference, Nasse.

CASE XLV (1892, June 17).—Francis J. Shepherd. Female, aged thirty-two. Chondrosarcoma. Four years before patient had suffered an injury to the shoulder. Since then pain had been a constant symptom. In March, 1890, a tumor at the upper extremity of the humerus was first noted. At the time of operating the shoulder-joint was fixed and surrounded by a tumor thirty inches in circumference. Interscapulo-thoracic amputation without removal of the clavicle. The subclavian artery was compressed against the first rib through an incision above the clavicle. Recovery. No recurrence noted up to the time of the patient's death, from some unknown disease, some time after the operation. Reference, *Maritime Medical News*, Halifax, 1894, Vol. vi, p. 394.

CASE XLVI (1893).—Von Bergmann. Circumscribed tumor of the head of the humerus. Interscapulo-thoracic amputation: recovered. Recurrence at the end of one year in muscles. Recurrence was operated upon. Final result unknown. Reference, Nasse.

CASE XLVII (1893).—Roth. Sarcoma of the head of the humerus. Interscapulo-thoracic amputation: recovery. No recurrence

up to two years. Reference, *Münchener medicinische Wochenschrift*, 1895, 940.

CASE XLVIII (1893, November 20).—W. W. Keen. Female, aged twenty. Myeloid sarcoma of the upper part of the humerus, scapula, and part of clavicle. Interscapulo-thoracic amputation. Air entered subclavian vein. Recovery. No recurrence up to May 10, 1894 (six months). Reference, *American Journal*, 1894, Vol. cvii, p. 703.

CASE XLIX (June 1).—A. J. Ochsner. Male, aged forty-six. Enchondrosarcoma with colloid degeneration. Four months before operation there was noticed two hard nodulated tumors, one over the supraspinous fossa and one over the end of the clavicle. These doubled in size in the last five weeks. Interscapulo-thoracic amputation: recovery. No recurrence. In good health fifteen months after the operation. Reference, *ANNALS OF SURGERY*, Philadelphia, 1895, Vol. xxii, 736-742.

CASE L (1894, December 26).—W. W. Keen. Male, aged twenty-one. Sarcoma extending from the shoulder to the base of the neck, attached to both clavicle and scapula. Surface ulcerated. Shoulder-joint still somewhat movable. In May, 1893, had had a fracture of the clavicle. In June, 1895, a tumor at the site of the old fracture was removed by Dr. Stout, of California. This immediately recurred. For one month previous to Dr. Keen's operation the patient had been under the care of Dr. Coley, of New York, for treatment by the toxins of erysipelas and prodigious, without obvious benefit. Interscapulo-thoracic amputation: recovery. No recurrence. Was in good health February 4, 1895 (two months). Reference, *ANNALS OF SURGERY*, Philadelphia, 1895, Vol. xxi, 715-718.

CASE LI (1894).—Dubar. Male, aged twenty-seven. Osteosarcoma of upper extremity of humerus. Interscapulo-thoracic amputation: recovery. Recurrence at the end of four months. Reference, "Statistique opératoire," Lille, 1897, 163.

CASE LII (1895, January 12).—G. E. Armstrong. Female, aged thirty-four. Sarcoma. Two years before, patient had fractured left humerus during an eclamptic seizure. Before the splints applied for this were removed, there appeared a small, hard, painless tumor in the anterior part of the axilla. This disappeared in about one year, but the shoulder has been more or less stiff since. In August, 1894, she again injured the shoulder, which rapidly became swollen and painful. Two months prior to the operation a nodulated tumor appeared over the anterior part of the shoulder. The joint became fixed. There

was egg-shell crepitation. Aspiration showed a reddish-brown gelatinous fluid. Interscapulo-thoracic amputation. No hæmorrhage. No shock. Recovery. Discharged in seventeen days. No recurrence up to December 27, 1895 (eleven months). Reference, *Montreal Medical Journal*, 1895 and 1896, Vol. xxiv, 666.

CASE LIII (1895).—Roth. Sarcoma of the humerus. Interscapulo-thoracic amputation: recovery. No details. Reference, *Münchener medicinische Wochenschrift*, 1895, 940.

CASE LIV (1895).—Dirksen. Male, aged thirty-four. Large fluctuating tumor of humerus. Interscapulo-thoracic amputation: recovery. Reference, *Berliner klinische Wochenschrift*, 1895, 1044.

CASE LV (1895).—Von Bergmann. Sarcoma of the head of the humerus. Interscapulo-thoracic amputation: recovery. Reference, Nasse.

CASE LVI (1895).—G. Houzel. Female, aged forty-three. Osteosarcoma of the right shoulder and upper third of the humerus. Interscapulo-thoracic amputation: recovery. No recurrence three and a half years after the operation. Reference, *Archives Prov. de Chirurgie*, 1896, No. 1, p. 13.

CASE LVII (1896, February 13).—A. T. Cabot. Male, aged twelve. Round-celled sarcoma of the scapula, involving the soft parts about the shoulder. Interscapulo-thoracic amputation: recovery. Injections of the toxins of the streptococcus of erysipelas and of the bacillus prodigiosus were practised for three weeks. Three months after the operation several bulbous outgrowths of the ends of the cervical nerves were removed. There was no recurrence at that time. Recurrence in the brain five months after operation. Death a few weeks later. Reference, *Boston Medical and Surgical Journal*, 1896, Vol. cxxxv, 411.

CASE LVIII (1896, March).—H. C. Cameron. Male adult. Spindle-celled sarcoma. Thirteen months before the operation there was noticed a movable tumor in the axilla, which grew rapidly. This was lanced, resulting in profuse hæmorrhage, following which, at intervals, there were repeated hæmorrhages. Interscapulo-thoracic amputation: recovery. Nine weeks after operation a neuroma of the severed cords of the brachial plexus was discovered. A bad prognosis was entertained. Cameron said that he "would not be surprised to find a secondary development in the lungs." Reference, *Glasgow Medical Journal*, 1896, Vol. xvi, p. 302.

CASE LIX (1896, May 31).—E. F. Elliot. Female, aged seventy-five. Myxosarcoma of the scapula and soft parts around the shoulder.

On September 24, 1892, a small tumor was removed from the scapula. This recurred, and was again removed two weeks later. Since then it had recurred and been removed twelve times. Interseapulo-thoracic amputation: recovery. No recurrence four and a half months after the operation. Reference, *Lancet*, London, 1896, Vol. ii, 1304.

CASE LX (1896).—Schwartz. Female, aged twenty. Osteofibrochondroma of the upper part of the humerus. Interseapulo-thoracic amputation: recovery. No recurrence when last seen, some months after the operation. Reference, Personally communicated by the operator to Berger, *Société anatomique*, July, 1897.

CASE LXI (1896).—Alexander Posadas. Female, aged fifteen months. Osteosarcoma of the humerus, shoulder, and forearm. This was first noticed, six months before operation, as a painful, movable tumor in the soft parts on the antero-internal aspect of the shoulder. This is the youngest case to be found in the literature. Interseapulo-thoracic amputation: recovery. No recurrence seven months after the operation. Reference, *Revue de Chirurgie*, 1897, No. 10, p. 805.

CASE LXII (1896, November 16).—R. Steer Bowker. Male, aged sixteen. Sarcoma. This was a globular swelling of the left shoulder-joint and upper arm, restricting the movements of the joint. It had been present for four months. There was a history of repeated blows over the shoulder. Interseapulo-thoracic amputation: recovery. Slight infection. No further data. Reference, *Australian Medical Gazette*, Sydney, 1897, Vol. xvi, p. 13.

CASE LXIII (1897).—Quénu. Male, aged fifty-seven. Round-celled sarcoma of the head of the humerus. Interseapulo-thoracic amputation: recovery. Death four months later from recurrence. Reference, Personally communicated by the operator to Berger, *Société anatomique*, March, 1897.

CASE LXIV (1897).—Kirmission. Male, aged ten. Spindle-celled sarcoma of the upper extremity of the humerus, involving the subclavian vessels. Interseapulo-thoracic amputation: recovery. Death seven months later. Reference, Personally communicated by the operator to Berger.

CASE LXV (1897).—Paul Berger. Male, aged twenty-eight. Myxoma of the humerus. Involvement of the glands at the time of the operation. Interseapulo-thoracic amputation: recovery. No recurrence eighteen months after the operation. Reference, *Revue de Chirurgie*, 1898, No. 10, p. 875.

CASE LXVI (1897).—Rochet. Male, aged twenty-eight. Small

celled osteosarcoma of the diaphysis of the humerus. Interscapulo-thoracic amputation: recovery. Reference, *Société de Chirurgie de Lyon*, 1897-98, No. 2, p. 57.

CASE LXVII (1898).—M. Barling. Male, aged fifty-three. Myeloid sarcoma, involving two-thirds of the right arm, the shoulder-joint, the outer end of the clavicle, the spine of the scapula, filling the axilla, and extending under the pectoral muscles. Three and a half years before there had been a spontaneous fracture of the humerus. Interscapulo-thoracic amputation: recovery. Multiple metastases six months later. Reference, *British Medical Journal*, 1898, Vol. i, p. 883.

CASE LXVIII (1898).—M. Barling. Male, aged thirty-seven. Periosteal sarcoma of seven months' duration, involving the upper two-thirds of the arm and encroaching upon the shoulder. Interscapulo-thoracic amputation: recovery. Complicated by a severe attack of pneumonia. No recurrence fifteen months after operation. Reference, *British Medical Journal*, 1898, Vol. i, p. 883.

CASE LXIX (1898, January).—C. B. Porter. Male, adult. Malignant disease (recurrence in scar, above elbow, and in glands of axilla). Nineteen years before there had been a tumor of the base of the thumb. This was incised and enucleated from time to time. It finally involved the whole hand. The forearm was amputated three and one-half months before the present operation. Interscapulo-thoracic amputation: recovery. No recurrence two weeks after the operation. Reference, *Boston Medical and Surgical Journal*, 1898, Vol. cxxxix, p. 389.

CASE LXX (1898, July).—Russell S. Fowler. The history of the case operated upon by myself is as follows: E. S., housewife, fifty-one years of age, born in Germany, was admitted to the Brooklyn Hospital, service of Dr. George Ryerson Fowler, July 22, 1898. The patient was referred to the hospital by Dr. Burr Mosher, with the diagnosis of osteosarcoma of the humerus.

Previous History.—There was no history of injury. One year and a half before admission to the hospital the patient had noticed a gradually increasing swelling, situated a few inches above the left elbow. There was at first no inconvenience attached to this. Soon, however, the swelling began to increase rapidly. The arm became painful. This pain was worse at night. She consulted her physician, who attempted the local removal of the growth. Following this she was free from recurrence for about six months. The tumor then recurred. The overlying skin became ulcerated. From this time on

the patient lost considerably in weight and strength, and on account of the severe pain was unable to move the arm. She finally consulted Dr. Mosher, who referred her to me.

Condition on Admission.—The patient was an undersized German woman, thin, and anæmic. Her left arm was useless and supported by a sling. There was a tumor, the main part of which was as large as an orange, connected with the shaft of the humerus a few inches above the elbow. This tumor merged into the shaft above, and below involving approximately two-thirds of the shaft of the bone. The most prominent portion presented antero-internally. Over this the skin was ulcerated. The triceps muscle was also the seat of the disease, which was evidently rapidly extending along the fascial planes to the shoulder region. It was impossible to state definitely the limits of the disease. Palpably no disease could be made out above the junction of the middle with the upper third of the bone. The axilla of this side was more resistant than that of the other side, but no definite tumor could be mapped out. The case was diagnosed as a rapidly extending osteosarcoma of the shaft of the humerus, with fascial and glandular involvement by extension. In view of the rapidity of the growth, the manner of progression along the triceps, the possibility of involvement of the scapular and shoulder regions, although no palpable disease was present in the latter two, I deemed it advisable to remove the entire upper extremity. Careful examination of the chest and abdomen failed to show any visceral involvement. The case was evidently one in which an extensive operation held out a good prospect of cure.

Operation.—This took place the day after admission. The delay of a day was obligated by the necessity of thoroughly cleansing the parts. The duration of the operation was an hour and twenty minutes. Fifteen ounces of ether were used. The time employed was far in excess of that which is usually necessary. This was because of the wretched manner in which the patient took the anæsthetic. It was necessary to stop the administration of the anæsthetic at times, and resort to the administration of oxygen, repeated hypodermics of whiskey and strychnine and artificial respiration.

Step 1.—An incision was made down to the periosteum covering the middle third of the clavicle. The periosteum was elevated. A chain-saw was passed around the junction of the inner with the middle third of the bone, and the clavicle sawn through. The outer two-thirds of the bone were dislocated outward and upward. The underlying periosteum was carefully incised and the subclavian vessels

identified. It was at this point in the operation that the patient's condition first became alarming. The pulse became so feeble that the pulsations of the subclavian artery were barely perceptible. This necessitated some little delay. Happily, with the withdrawal of the anæsthetic and the administration of several hypodermics of whiskey, the condition of the heart improved. The subclavian artery and vein were surrounded by catgut ligatures, the artery being tied first and then the vein. Two ligatures were applied to each and the vessels cut between the ligatures. There was some difficulty in securing the vein, as a large tributary vein tore between the points of ligature. This bled sufficiently to obscure for the moment the field of operation and necessitate the application of an additional ligature.

Step 2.—An incision, beginning at the middle of the primary incision, was curved downward, well in front of the axilla, to the border of the latissimus dorsi, thence upward over the body of the scapula to the end at the middle of the primary incision. This was deepened throughout down to the muscular layer. The pectoralis major and minor were sectioned, the brachial plexus cut at a level with the subclavian artery and vein. The skin and subcutaneous tissue were reflected from over the scapula. Here again the patient's condition became alarming. The arm was rapidly disarticulated at the shoulder-joint so that, in case of need, dressings could be applied, and the operation concluded at a second sitting. Happily, again the patient rallied. The scapular muscles were cut, a clamp placed upon the suprascapular artery and vein, and the scapula rapidly removed. The suprascapular vessels were ligated. The large wound resulting was carefully cleansed of all fat and debris, the edges of the wound approximated with silkworm-gut sutures, and a large dressing was applied. There was no indication for drainage, so none was used. Hæmostasis had been perfect. During the operation the only blood lost was that from the torn tributary vein while trying the subclavian. The patient rallied splendidly from the operation. There was no shock. The bad symptoms present during the operation were due entirely to the anæsthetic. The dressing was not changed until the seventh day, when the sutures were removed. The progress to recovery was uneventful, except for a slight skin infection from a suture at the upper angle of the wound. The patient was discharged on August 21, 1898.

Pathologist's Report.—The gross appearance of the growth suggested osteosarcoma, and the microscope confirmed this. The soft parts up to and above the level of the shoulder-joint were infiltrated

with sarcomatous tissue, not palpable, but shown by the microscope. The axilla was also the seat of sarcomatous infiltration. The operation had gone wide of the disease. This report satisfied me that the patient had a fair chance for final cure.

Final Result.—One year after the operation I examined the case. There was no evidence of recurrence. The patient had gained greatly in weight and strength. No prothesis was used, as the patient objected to it. More recently I have heard that she still continues in good health.

CASE LXXI (1899).—George Ryerson Fowler (here first fully reported). F. S., by occupation a farmer, seventy-five years of age, a native of France, was admitted to the Brooklyn Hospital June 12, 1899, with the following history. There had been pain in the shoulder and elbow for one year. There was no history of injury. During the last three months the arm had become swollen, tense, red, and painful on pressure. A tumor had appeared on the anterior border of the axilla about the same time that the arm began to noticeably increase in size. When admitted, the tumor in the axilla had broken down and was discharging pus. The arm was much swollen, being largest just above the elbow. The skin had ulcerated at this point. A profuse discharge escaped through the ulceration. It was decided to first remove the infected mass from the axilla and from beneath the pectoral muscles. This was done on June 13. The anæsthetic was taken rather badly. Examination by the microscope proved the tumor to be an alveolar carcinoma. Six days later the patient was again anæsthetized, the wound having in the mean time become clean, and interscapulo-thoracic amputation performed. The clavicle was first sawn through at the junction of its inner and middle third. It was then elevated and the subclavian artery tied. Following this the extremity was quickly and easily removed. The hemorrhage in this case was not excessive, though more blood was lost than is common in such operations. The entire wound, with the exception of the lower angle, was closed with silkworm gut. A plain gauze drain was employed. The patient rallied from the shock of the operation, but this, together with an organic lesion of the heart, caused his death the next day.

CASE LXXII (1899, April 12).—Le Conte, Philadelphia. Male, aged forty-nine. Sarcoma. The tumor had been in existence for three and one-half years. It had twice been removed locally, the last time by Dr. Ashhurst, who removed with it one-fifth of the clavicle and all of the acromion process. This was in May, 1897. Inter-

scapulo-thoracic amputation. At the time of this operation the overlying skin had ulcerated. Recovery. When reported, the wound had not healed. Reference, *ANNALS OF SURGERY*, 1899, Vol. ii, p. 260.

ANALYSIS OF THE PUBLISHED CASES.

Variety of Tumor.—Fifty-eight of these cases were sarcomata; four (Nos. VI, XIV, XXIX, LX) belong to the chondromata; three (Nos. II, IV, V) were encephalomata; two (Nos. I, LXIX) were "malignant tumors;" one (No. LXXI), alveolar carcinoma; one (No. LXV), myxoma; one (No. XII), "rapidly growing tumor;" one (No. XLVI), circumscribed recurrent tumor; one (No. LIV), "large, fluctuating tumor." Of the sarcomata group, thirteen (Nos. III, VII, VIII, XVII, XVIII, XXIII, XXVI, XXXIII, LI, LVI, LXI, LXVI, LXX) were osteosarcomata; three (Nos. X, XLV, XLIX), chondrosarcomata; six (Nos. XI, XV, XXIV, XLII, LVIII, LXIV), spindle-celled sarcomata; one (No. LIX), myxosarcoma; one (No. XX), fibro-sarcoma; two (Nos. XLVIII, LXVII), myeloid sarcomata; one (No. XXI), mixed-celled periosteal sarcoma; four (Nos. XXXI, XXXVIII, LVII, LXIII), round-celled sarcomata; one (No. XXXIV), encapsulated periosteal sarcoma; two (Nos. XXXVII, LXVIII), periosteal sarcomata; one (No. XLIII), cystic sarcoma; twenty-three (Nos. IX, XIII, XVI, XIX, XXII, XXV, XXVII, XXVIII, XXX, XXXII, XXXV, XXXVI, XXXIX, XL, XLI, XLIV, XLVII, XLVIII, LII, LIII, LV, LXII, LXXII) are reported simply as sarcomata.

Mortality.—Of these seventy-two cases, eight cases died; that of McLeod (No. V) of hæmorrhage and shock. This patient was but two years of age, and the tumor an enormous one. Thiersch's (No. VI) of œdema of the lungs and empyema, in five days. Fergusson's (No. VII) of shock, in four days. This case had a fatty heart. Von Langenbeck's (No. IX) of secondary hemorrhage, on the fifth day. Macnamara's (No. X) of shock, on the following day. McGill's (No. XII) of infection, on the sixth day. Parkes's (No. XXX) of shock, in fifty-six hours. Fowler's (No. LXXI) of shock, on the following day. This case had mitral regurgitation and took the anæst-

thetic badly. This brings the mortality of the primary operation up to $11\frac{1}{3}$ per cent. This is more than twice the mortality conceded by Berger. Von Bergmann's fatal case has been placed in the unclassified list of cases, as the operation was a much more extensive procedure than interscapulo-thoracic amputation. It does not seem to me that 11 per cent. is too high a mortality for this operation.

Dr. Stephen Rogers, in 1869 (*New York Medical Journal*), published a table of sixty-four operations for partial or complete excision of the scapula. Of these fifteen included removal of the arm and part or all of the clavicle. The mortality in these latter cases was 20 per cent.

Lewis's analysis (*ANNALS OF SURGERY*, 1890, Vol. xi, p. 91) of Berger's first list of fifty-one cases, twenty-six cases not mentioned by Ashhurst, shows a mortality in traumatic cases of 30 per cent., and of about 20 per cent. in those cases where the interference is on account of malignant disease. Butlin's mortality for amputation at the shoulder-joint (twenty-four cases) was $33\frac{1}{3}$ per cent. This comprised cases occurring between 1867 and 1887. Of fourteen cases, occurring between 1877 and 1887, the mortality was $28\frac{1}{2}$ per cent. Of twenty other cases collected by the same author, the mortality was 25 per cent. Barling (*Clinical Society of London*) collected nineteen cases recorded since 1890. All recovered. Interscapulo-thoracic amputation was performed eight times at the Birmingham Hospital, all the patients recovering from the operation.

Ashhurst, in 1895, tabulated thirty-nine cases, in which interscapulo-thoracic amputation had been done for various lesions. These, in addition to the fifty-one cases tabulated by him in 1881, make a total of ninety cases. It is to be remembered that this list includes cases operated upon for extensive traumatism as well as those done for malignant growths. Taking all cases, it is found sixty-six of these are known to have recovered, while twenty-two are known to have terminated fatally. This gives a mortality of $24\frac{2}{3}$ per cent. for all of the eighty-eight cases. In the series of 1895, thirty-nine cases, the result in two is unknown, twenty-eight recovered, and nine died, making a mortality of 24.3 per cent. In the series of

1881, comprising fifty-one cases, there were thirty-eight recoveries and thirteen deaths, making a mortality of 25.5 per cent. All statistics of this kind are valueless, as the mortality of the operation varies greatly according to the lesion for which it is done, injury giving a high mortality, malignant disease a comparatively low mortality, when the operation is done primarily. Ashhurst gives a mortality of 37.7 per cent. in 1387 cases (table published in 1881) of amputation at the shoulder-joint for various lesions. ("International Encyclopædia of Surgery," vol. xiii, p. 647.)

In an address before the Surgical Congress in Berlin, June 4, 1888, Professor George Adelman presented, in tabulated form, sixty-seven cases in which the arm, scapula, and part or all of the clavicle had been removed at various times and for various reasons. There were three cases of gunshot injury, all of which recovered; seven cases of comminuted fracture, two of which recovered and five died; four cases of tearing accidents, which recovered; two cases of caries and one of osteomyelitis, two of which were cured. Fifty cases were operated upon for tumor: twenty-six cases of sarcoma; seven cases of chondroma, with three recoveries and four deaths; four cases of encephaloma, in two of which the time was too short to judge of their cure and two of which died, one from recurrence and one from shock. Of these fifty operations, in twenty-five the operation was primary interseapulo-thoracic amputation; ten of the twenty-five cases recovered (four of these ten are doubtful) and fifteen died. The operation was performed nineteen times in two sittings, with ten recoveries (two of which are doubtful) and nine deaths. Four cases were operated upon three times each, with three recoveries and one death. Two cases were operated upon six times each, one recovered and one died from recurrence. Of the entire fifty, twenty-four recovered and twenty-six died.

In forty-six cases collected by Berger, there were but two deaths from the operation. One of these (Kenneth McLeod's) was an infant of two years, with an enormous tumor of the shoulder. Death occurred immediately after the operation. The severity of such an operation in one so young was the

probable cause of death, though Posadas has operated by this method with success in a child of fifteen months. The other death occurred in one of Bergmann's cases, operated upon in 1889. The disease, sarcoma, was very extensive, necessitating resection of the first rib and sternum, and the excision of the subclavian vein and ligature of the right brachio-cephalic trunk, which was completely involved by the disease. The patient died two hours following the operation.

Final Results.—As previously stated, eight cases (Nos. V, VI, VII, IX, X, XII, XXX, LXXI) died as a result of the operation. No data regarding the final result is given in thirteen cases (Nos. XI, XIII, XVI, XXVIII, XXXII, XXXVIII, XXXIX, XLII, LIII, LIV, LV, LXII, LXVI). Two cases (Nos. XV, XLV) died of intercurrent disease before a year had elapsed. Sufficient time has not been allowed to elapse before reporting in eighteen cases (Nos. IV, XX, XXIII, XXIV, XXV, XXVII, XXXI, XXXIII, XXXV, XLVIII, L, LI, LVIII, LIX, LX, LXI, LXIX, LXXII). One case (No. LI) recurred at the end of four months, but the final result is not noted. This one probably died shortly after. One case (No. XLVI) recurred and was reoperated upon, but the final result is not noted. Eleven cases (Nos. I, II, XVIII, XIX, XXXVII, XL, XLI, LVII, LXIII, LXIV, LXVII) recurred, and death ensued in about six months following the operation. Three cases (Nos. XXI, XXII, XXVI) died from recurrence in about twelve months following the operation. One case (No. VIII) died from recurrence eighteen months after the operation. The remaining fourteen cases (Nos. III, XIV, XVII, XXIX, XXXIV, XXXVI, XLIII, XLIV, XLVII, XLIX, LVI, LXV, LXVIII, LXX) were well at the time when reported, one year or over after the operation.

For statistical purposes regarding ultimate cures only those cases may be used in which the final result is known, or which have been free from the disease for a longer period than one year. We cannot use the eight cases that died, for no one can say whether they would have escaped recurrence or not had they survived the operation. The thirteen cases which lack data cannot be used for this purpose; nor can the eighteen

cases be used in which sufficient time had not been allowed to elapse before they were reported. The two cases which died from intercurrent disease before a year had elapsed are not available; nor the case which recurred and was reoperated upon, but in which the final result is not noted. There remain thirty cases, sixteen of which died from recurrence, and fourteen of which were alive and well when reported one year and over following the operation. We may then, if these statistics are to be trusted, place the percentage of ultimate recoveries at $46\frac{2}{3}$.

Of the fourteen cases regarded as cured, three cases were well and free from recurrence one year after the operation: No. XXIX, Chavasse (1889); No. XLIV, von Bergmann (1892); No. XLIII, von Bergmann (1892); this last case of von Bergmann's died of an unknown cause shortly after the year had elapsed; three cases were free from recurrence at the end of fifteen months; No. XLIX, Ochsner (1894); No. LXVIII, Barling (1898); No. LXX, Fowler (1898); one was well at the end of eighteen months; No. XLV, Berger (1897); one at the end of two years; No. XLVII, Roth (1893); one at the end of three years; No. XVII, Heath (1883); two at the end of three and a half years; No. XXXIV, von Bergmann (1889); No. LVI, Houzel (1895); one at the end of four years; No. XXXVI, Ochsner (1891); one at the end of nine years; No. III, Mussey (1845); one at the end of fifteen years; No. XIV, Berger (1882).

It is interesting to note the disease present in these cases: Eleven were cases of sarcoma, two were enchondromata, and one a myxoma. The only case reported as cured in which there is a doubt of the malignancy of the growth is that of Chavasse. In the discussion of this case before the Royal Medical and Chirurgical Society Mr. Adams stated that it looked to him like a simple chondroma. Deducting this case from the cases reported cured, leaves 45 per cent. of permanent cures following primary interscapulo-thoracic amputation for malignant disease.

Of the forty-four cases collected by Berger, in addition to the two successful cases of his own, thirteen cannot be utilized by reason of the lack of data relating to their final outcome.

These are the cases reported by Syme, Lund, two of Bergmann's cases; those of Küster, Treves, Delorme, Ochsner, Direksen, Hall, the second case of Roth, and that of Rochet. In fourteen other cases recurrence took place or death by metastasis occurred at a longer or shorter interval following the operation. Local inoperable recurrences were noted in three of Bergmann's cases; in those of J. Boeckel, Dubar, Quénu, Kirnissou; immediate multiple metastasis in the case of Verneuil, May, E. Monod, in two of Bergmann's cases, and in one of Barling's cases; in four of the above the metastasis occurred in the lung; in those of May the metastasis was glandular. The longest period before recurrence in these cases was ten to fifteen months. In almost all of them, at the time of operation, there was involvement of the muscles in the neighborhood of the scapulo-humeral articulation; in some of the muscles of the scapula, and in some the axillary vein itself, was involved. Of these forty-four cases twenty-eight are useless for our purpose. In seventeen cases cure was confirmed respectively at the end of four months (Parkes). (In verifying this case I find that six weeks are given by Parkes as the last time the patient was seen), six months (Christopher Heath), eight months (May, van Iterson, Lewis, Posadas), nine months (Sondermayer), one year and over (Madelung, Chavasse, two cases of Bergmann's, Berger, Barling), two years (Roth), almost three years (Houzel), three years and six months (Bergmann), fifteen years (Berger), and, lastly, several months without more definite information (Schwartz). There are then ten cases (33 per cent.) which were without recurrences one year or more following the operation.

In addition to the cases in which typical interscapulo-thoracic amputation has been primarily done I have collected five in which the clavicle was not removed. These I have designated as *atypical interscapulo-thoracic amputation*. Two of these cases are incorrectly included by Berger in his table of 1898,—i.e., Hall, 1896, and Bergmann, 1886. In one of these cases, that of Esmarch, neither the immediate nor final result is noted. The other four recovered from the operation. In one no data concerning recurrence is noted. Three cases

died from recurrence respectively at the end of three and a half months, fifteen months, and two years, in each case the metastasis being in the lung. The effect of adding these cases to the table of typical cases would result in slightly lowering the mortality, and would at the same time lower the percentage of ultimate cures from 46 $\frac{3}{4}$ to 42 $\frac{2}{3}$.

(II) CASES OF ATYPICAL INTERSCAPULO-THORACIC AMPUTATION
WITHOUT REMOVAL OF THE CLAVICLE.

CASE LXXIII (1874, July 8).—Esmarch, Kiel. Male, aged fifty. Myxosarcoma of right axilla. Atypical interscapulo-thoracic amputation: recovery (?). This tumor had been present for five months. The subclavian vessels were ligated preliminarily. No date regarding the final result. Reference, Friedr. Heydenreich, "Ueber Exstirpation der Scapula," Inaugural Dissertation, Kiel, 1874.

CASE LXXIV (1883).—R. Barwell, London. Malignant tumor. Atypical interscapulo-thoracic amputation: recovery. Death from recurrence in two years. The recurrence was both local and metastatic in the lungs and liver. Reference, *British Medical Journal*, 1884, Vol. i, p. 412.

CASE LXXV (1886, July 15).—Von Bergmann, Berlin. Male, aged forty-four. Sarcoma of the humerus with involvement of the axillary glands. The growth had been present for six months. Atypical interscapulo-thoracic amputation. Preliminary ligation of the subclavian vessels. Recovery. Death from recurrence in the pleura and lung, November, 1887. Reference, Bramsfeld, "Dissertation."

CASE LXXVI (1887, February 6).—Obalinsky, Krakau. Female, aged twenty-two. Sarcoma. Atypical interscapulo-thoracic amputation: recovery. Death in three and one-half months from recurrence in the pleura. The subclavian vessels were ligated preliminarily. Reference, *Wiener medizinische Presse*, 1887, No. 19, p. 640.

CASE LXXVII (1896?).—G. C. Hall. Male, adult. Sarcoma of the shoulder region. The tumor was of enormous size; the skin over it was ulcerated; there was no attachment to the thorax. Berger reports this as a case of the complete operation, but the photograph in the original shows the clavicle *in situ*. Atypical interscapulo-thoracic amputation: recovery. No data concerning recurrence. Reference, *Lancet*, London, 1896, Vol. i, p. 353.

(TO BE CONTINUED.)